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New Optical Data on the Phase Diagram of Nitrogen

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Beamline(s): U2A

Introduction: The phase diagram of nitrogen is complex at moderate pressures and temperatures and has been little studied over a wider range until recently, when a theoretically proposed dissociation of nitrogen molecules under pressure [1] was confirmed experimentally [2-4].

Results: Here, we report the discovery of two new high-pressure molecular phases, ι and θ, with unusual vibrational properties, including strong infrared activity (Fig. 1). The phases have exceptionally large regions of P-T stability (or metastability), including regions where ε and ζ are thought to be the only stable phases of nitrogen (Fig. 2). The metastability of the ζ phase is also confirmed by low-temperature Raman and infrared measurements, which show that vibrational properties of solid nitrogen at low-T and moderate pressure depend on the transformation path.

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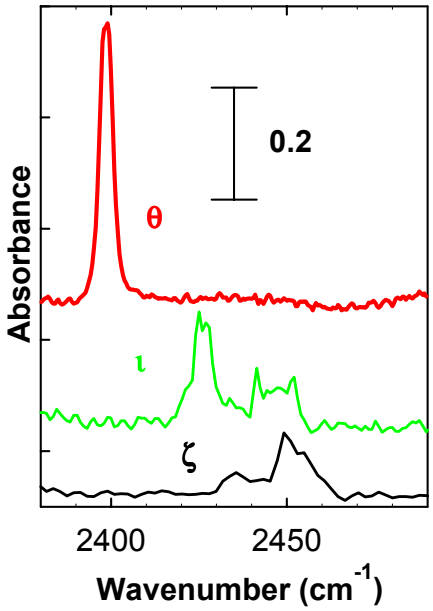

Fig. 1. IR spectra of ζ, ι and θ phases.

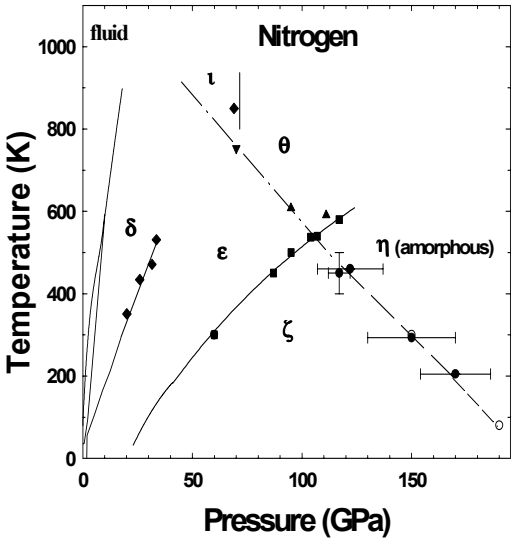

Fig. 2. Phase diagram of nitrogen